



**NOAA
FISHERIES**

SEDAR 74 Gulf of Mexico Red Snapper Stock Assessment: Assessment Webinar 8



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July 12, 2023

Topics for Current Assessment Webinar 8

- Review Topics from Webinar 7
 - Incorporating GRSC lengths and selectivity update
 - Incorporating SSB linked maturity
 - Explain internal natural mortality calc.
- Review of completed assessment TORs

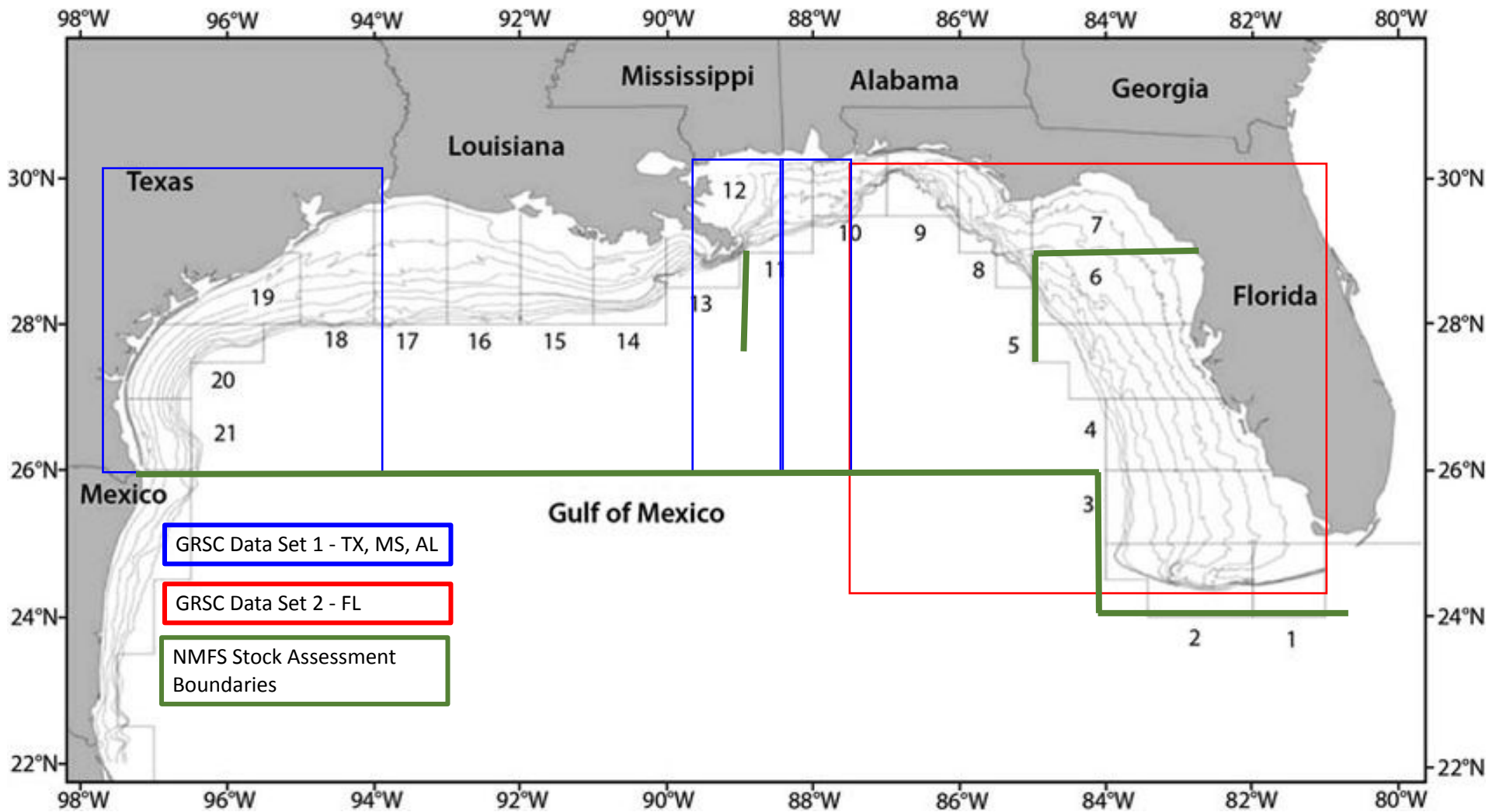
GRSC



Minimum Requirements for Composition Data:

- Appropriate spatial and temporal coverage
- Spatially balanced and consistent sampling
- A clear and consistent understanding of gear selectivity spatially

SEDAR 74 GOM RS Spatial Coverage



GRSC Length Composition Data Description

Data Set 1:

- Includes 2010-2020
- No indication of # measured vs seen (sampling protocol, max,etc.?)
- Only Alabama and Texas in 2018
 - VLL, BLL, ROV
- Multiple habitat types
- Data sources:
 - TAMCC, TWDP_ARP, TWDP_SEAMAP, University of South Alabama

Data Set 2:

- Assuming from one source across entire GOM FL shelf
- Stereocamera/Lasers for measurement
- Multiple habitat types
- Number seen vs measured available, max 24 measured at a site

GRSC Length Composition Data Triage

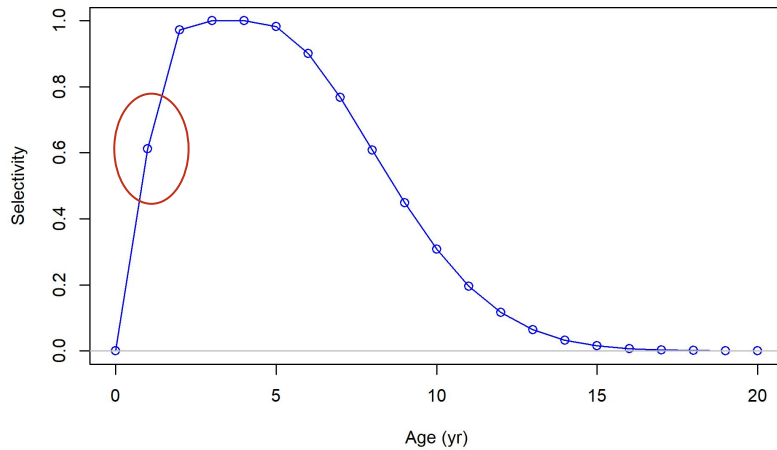
- Texas data includes SEAMAP samples and Texas Parks and Wildlife
 - Risk of double counting data
 - Sampling protocol difference?
 - Which gear/habitat should be used?
 - May not have enough data for multiple gears
- Provided Florida data was not split according to new stock ID bounds
 - When split, data weighting methodology needs to be discussed (considering habitat/depth, etc.)
- Discussion is needed on how to include the LGL Louisiana study for a complete western composition.

GRSC Selectivity Methodology Options

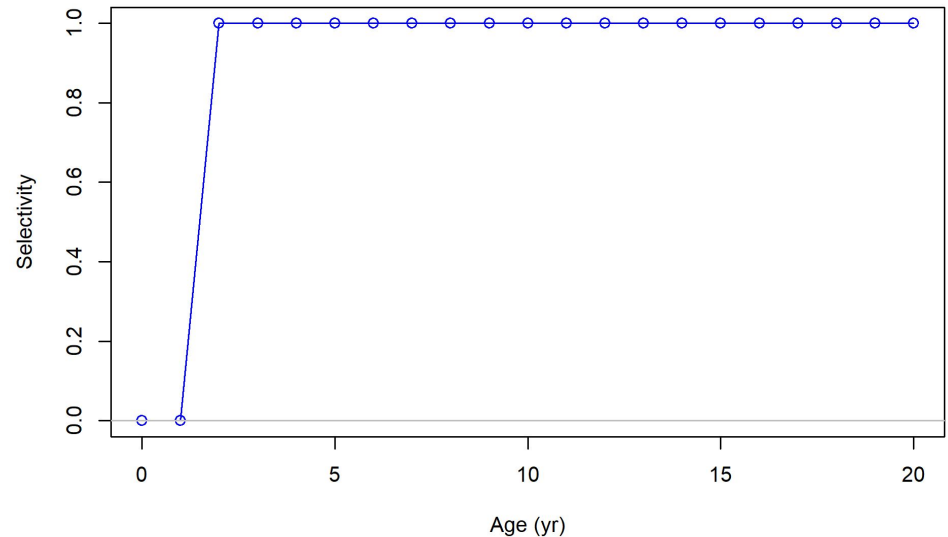
1. Assume 100% selectivity of ages 2+
 - A simplifying assumption given questions concerning GRSC length composition data
2. Assume gear differences regionally, with peak selectivity of roughly ages 2-5 in all regions.
 - In SS: Est. 4/6 params for a double normal. Assume zero to 100% selectivity prior to age 2 and 100% to zero (floating) at the plus group. Use symmetric beta priors w/ small SD.
3. Assume gear differences regionally but force age 0 and 1 to zero selectivity

GRSC Selectivity (West)

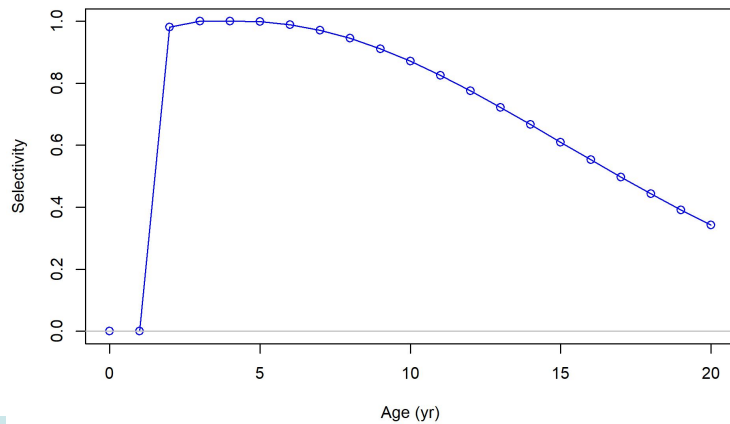
Estimated. Force age 0 to 0



Fixed at 1 for ages 2+

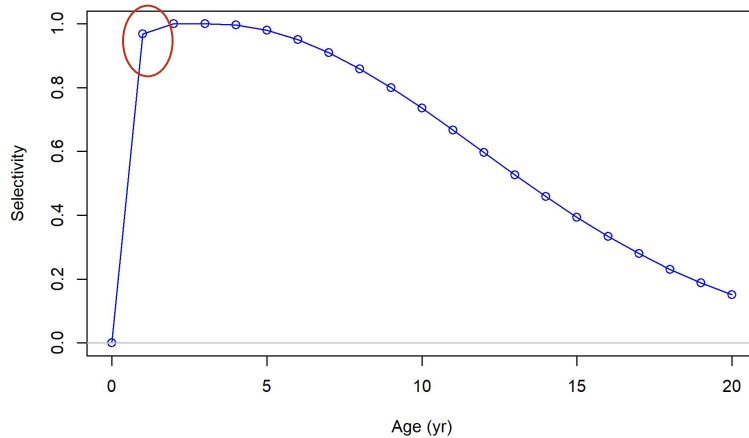


Estimated. Force age 0 and 1 to 0

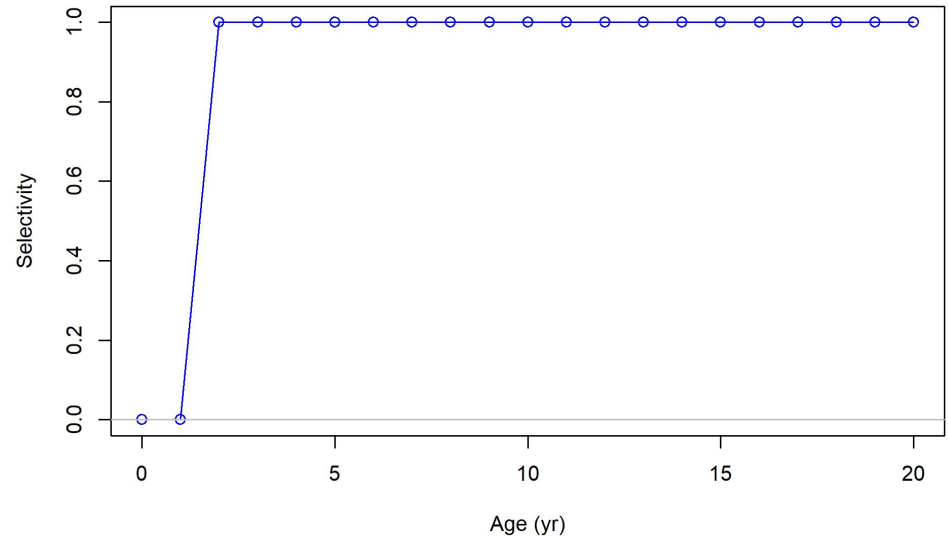


GRSC Selectivity (Central)

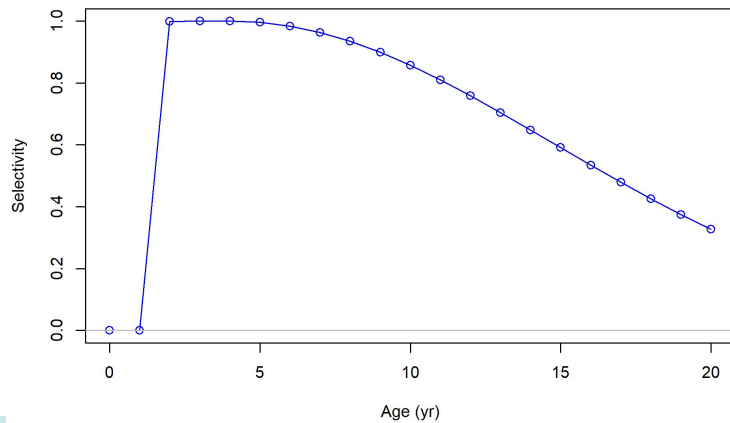
Estimated. Force age 0 to 0



Fixed at 1 for ages 2+

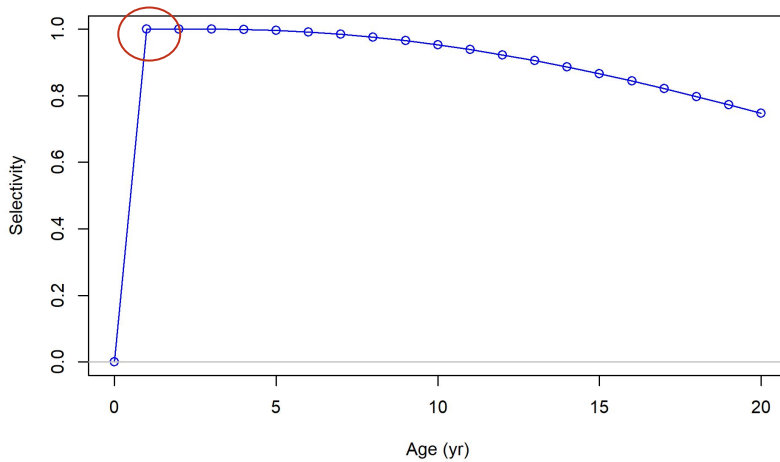


Estimated. Force age 0 and 1 to 0

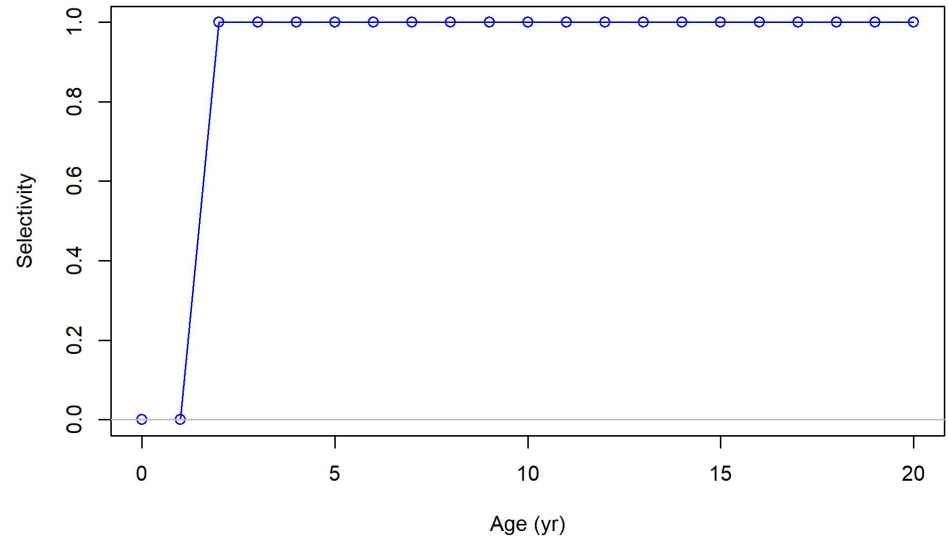


GRSC Selectivity (East)

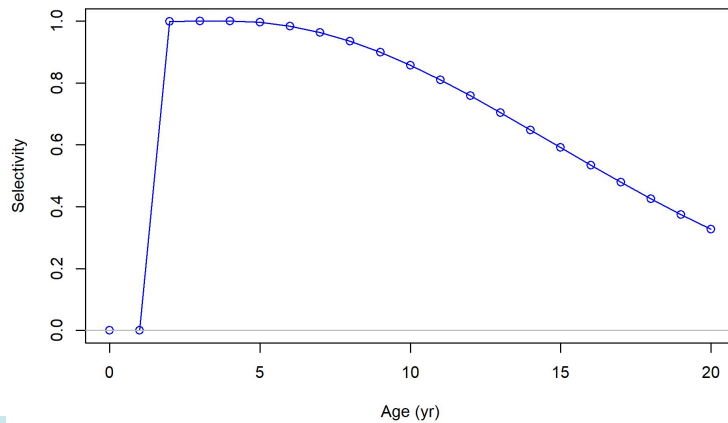
Estimated. Force age 0 to 0



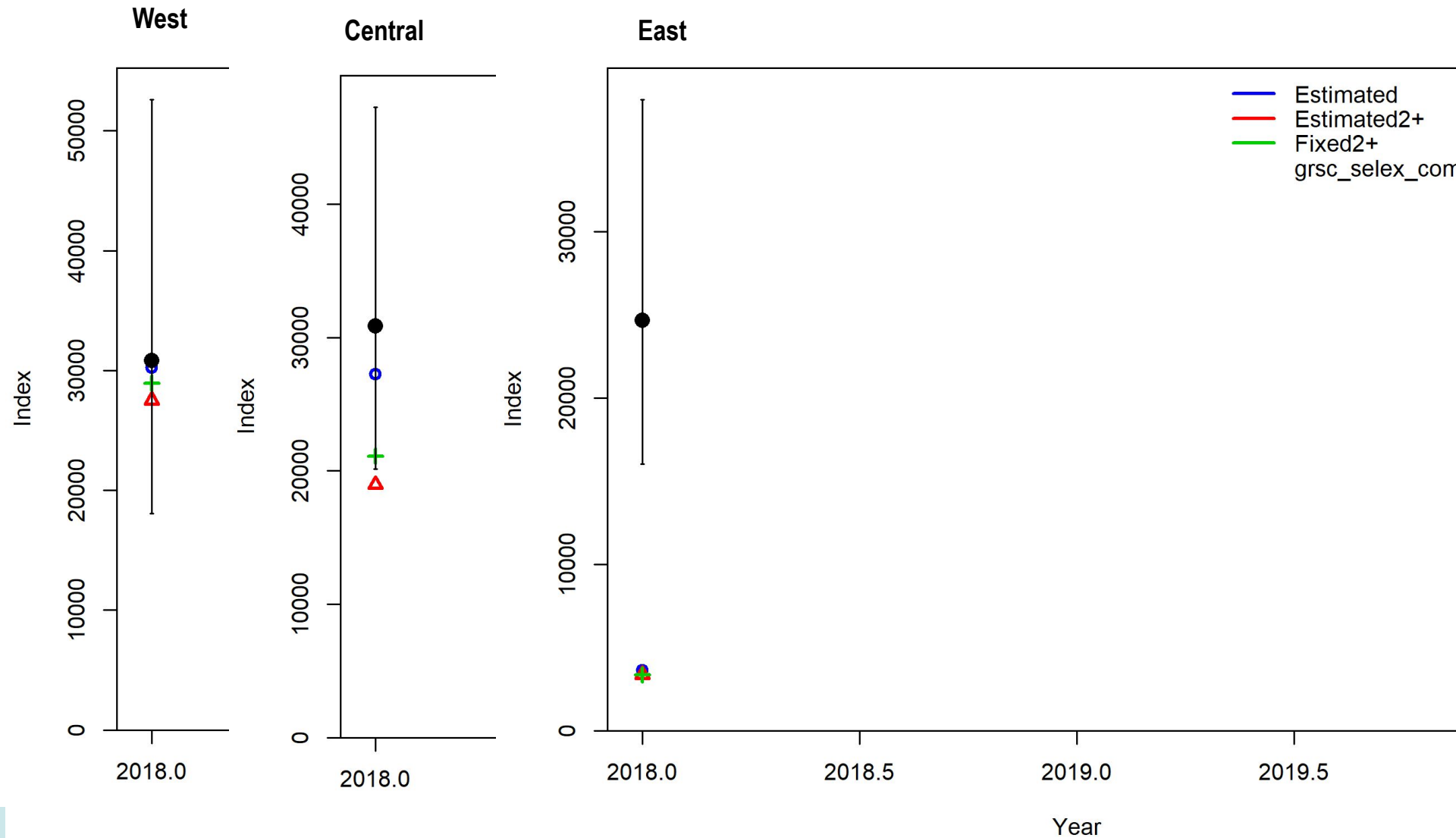
Fixed at 1 for ages 2+



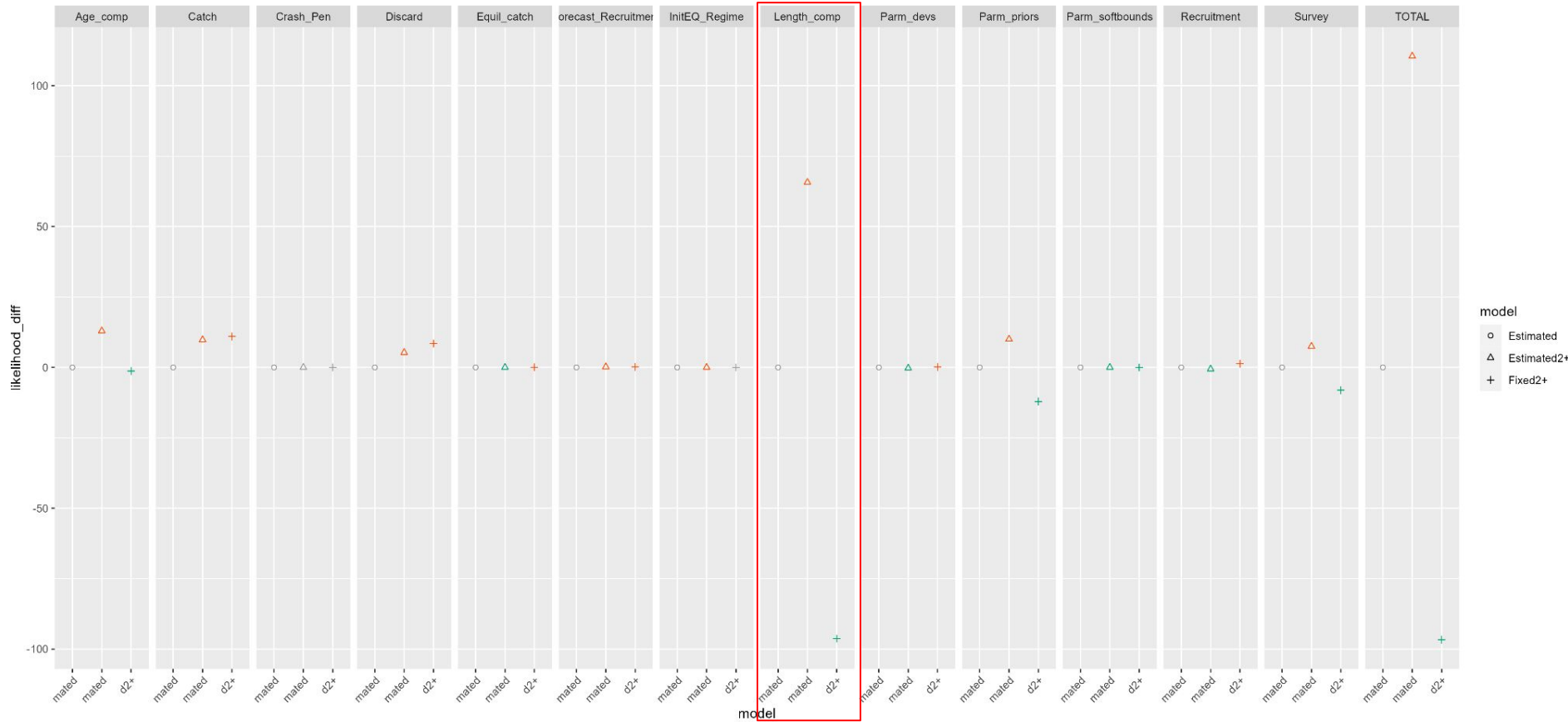
Estimated. Force age 0 and 1 to 0



GRSC Index Fit Comparison



GRSC Likelihood Comparison



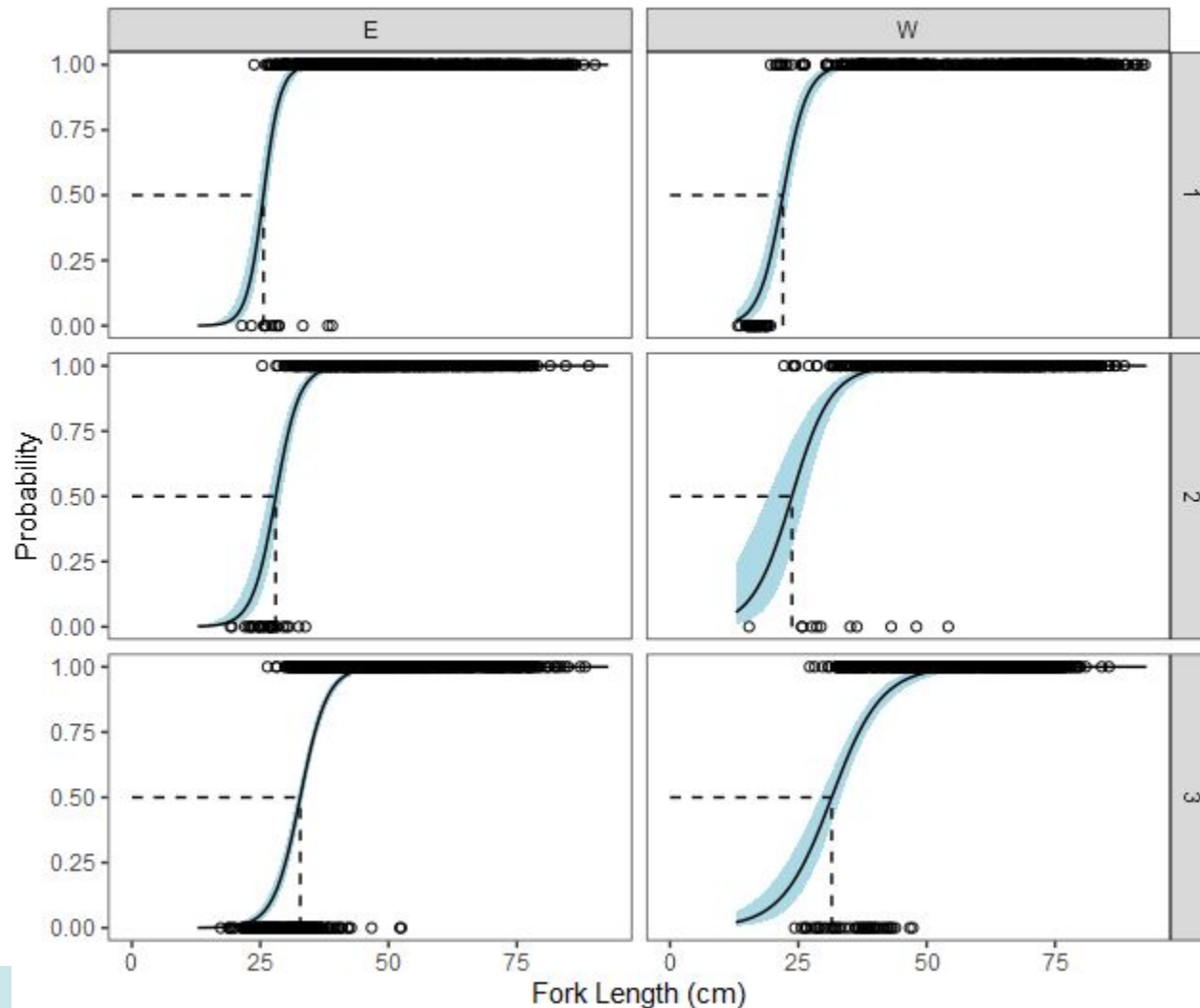
Analytical Team Recommendation

- East - Assume 0% for ages zero and one and assume 100% selectivity for age 2+
- West and Central:
 - ~~Allow model flexibility in estimating selectivity for GRSC, where it can.~~
 - **Proceed for RT with model configured to force age 0 and 1 to have selectivity equal to 0 and estimate the rest.**
 - **w/ peer reviewed justification**
- For OA, optimal utilization of length composition data will be an important topic for the GRSC topical working group.
- For OA, use GRSC-specific composition data to estimate survey selectivity if recommended by the TWG or continue with RT assumption.

Maturity Linked to SSB



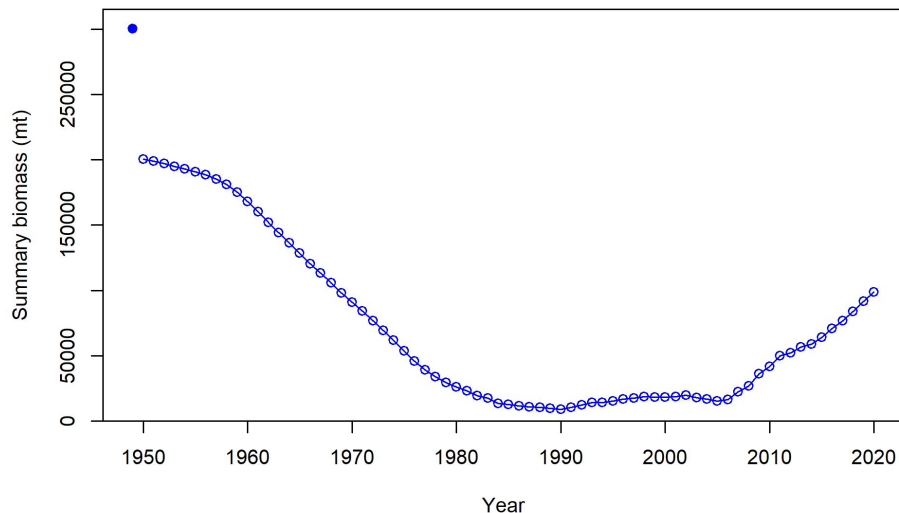
LH Group Maturity Curves



- Spatial and temporal differences in maturity.
- 1 - '91 - '08
- 2 - '09 - '16
- 3 - '17 - '19

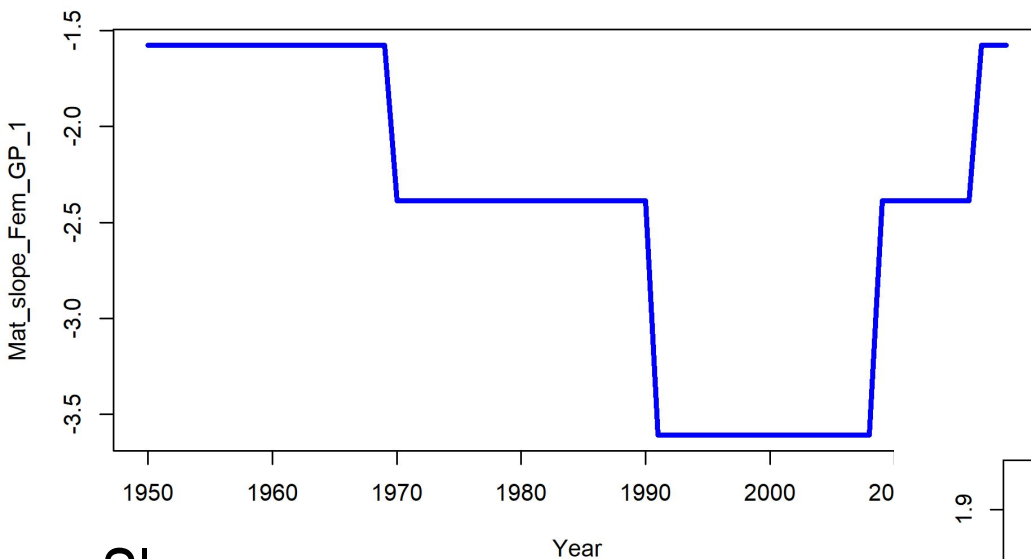
Time Varying Maturity Considerations in SS

- LH working group labeled the periods as 1 - overfished, 2 - rapidly recovering, 3- stabilizing.
- To use time-varying maturity we must specify maturity values for data-free periods '50 - '90 (Pbase).



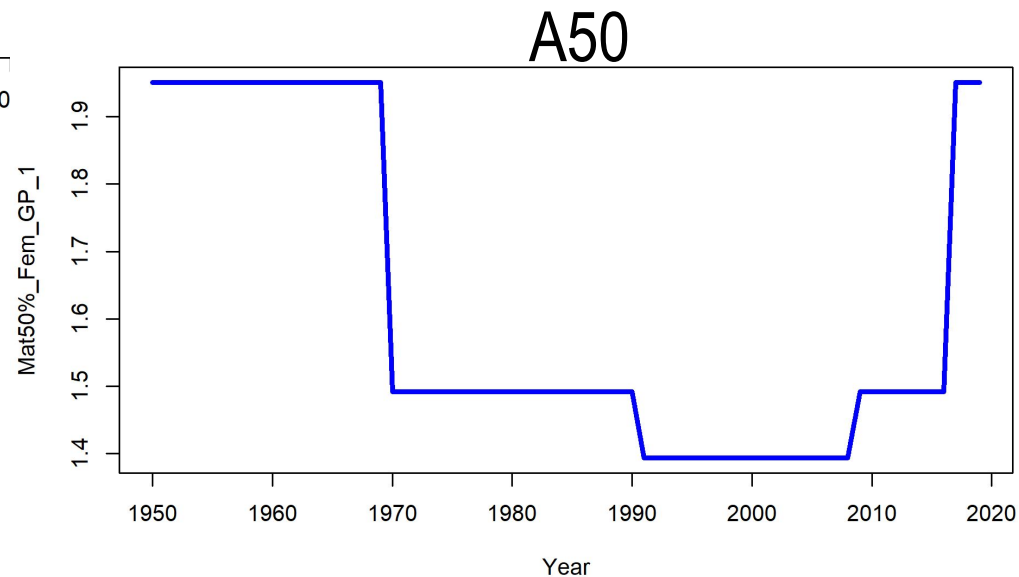
Use model estimate biomass to define pre-data periods.

Time Varying Maturity - Time Blocks



East region
example

Slope



A50

Time Varying Maturity - Linked to SSB

A suggestion from the ADT:

- An SSB relationship to aid in model forecasting

$$P_y = P_{base} + P_t * E_y$$

Where:

y = year

P_y = Maturity slope or A50 in year, y

P_{base} = Base Maturity slope or A50 (1950)

P_t = Scaling parameter (i.e., effect size)

E_y = $\text{Log}(\text{SSB}_y / \text{SSB}_0)$ in year, y

Time Varying Maturity - Linked to SSB

Goal: Reproduce shifts seen by the LH group

Issue: Model has almost no information to inform P_t or P_{base}

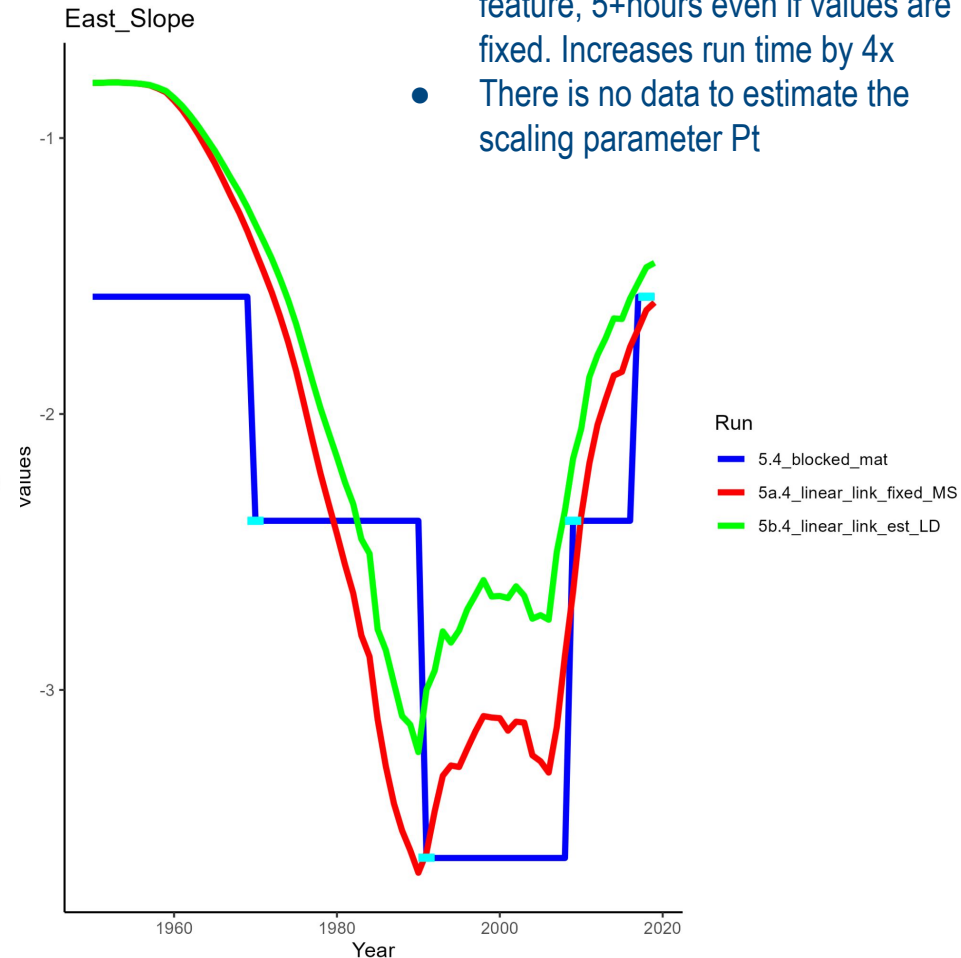
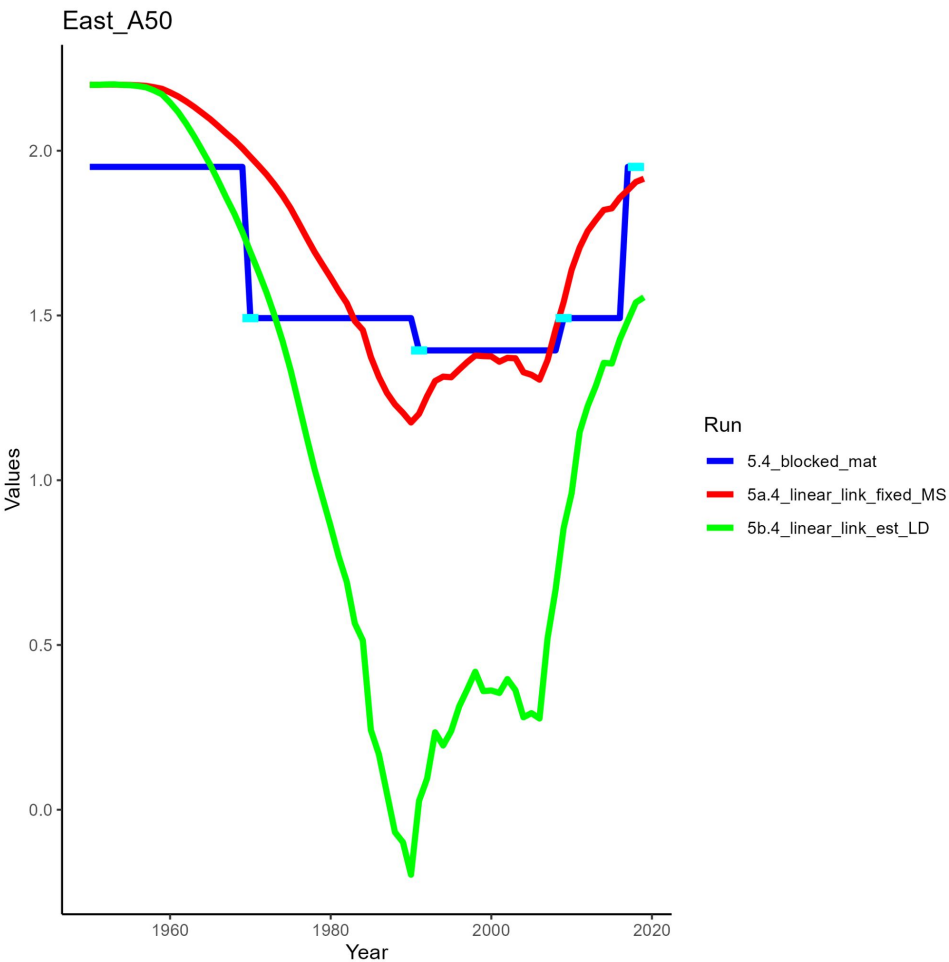
Solutions:

$$P_y = P_{base} + P_t * E_y$$

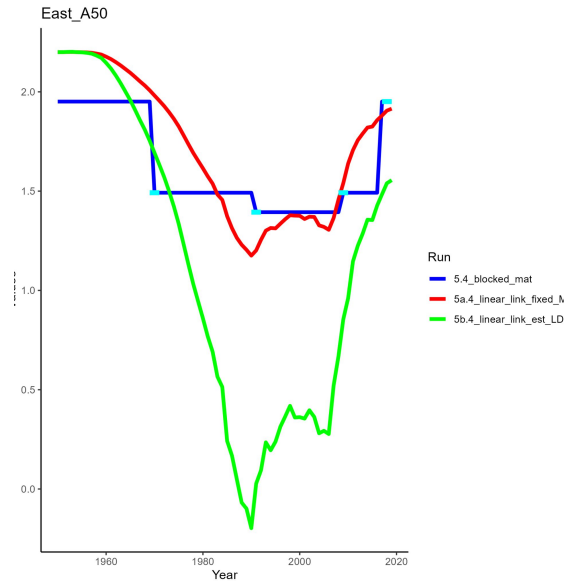
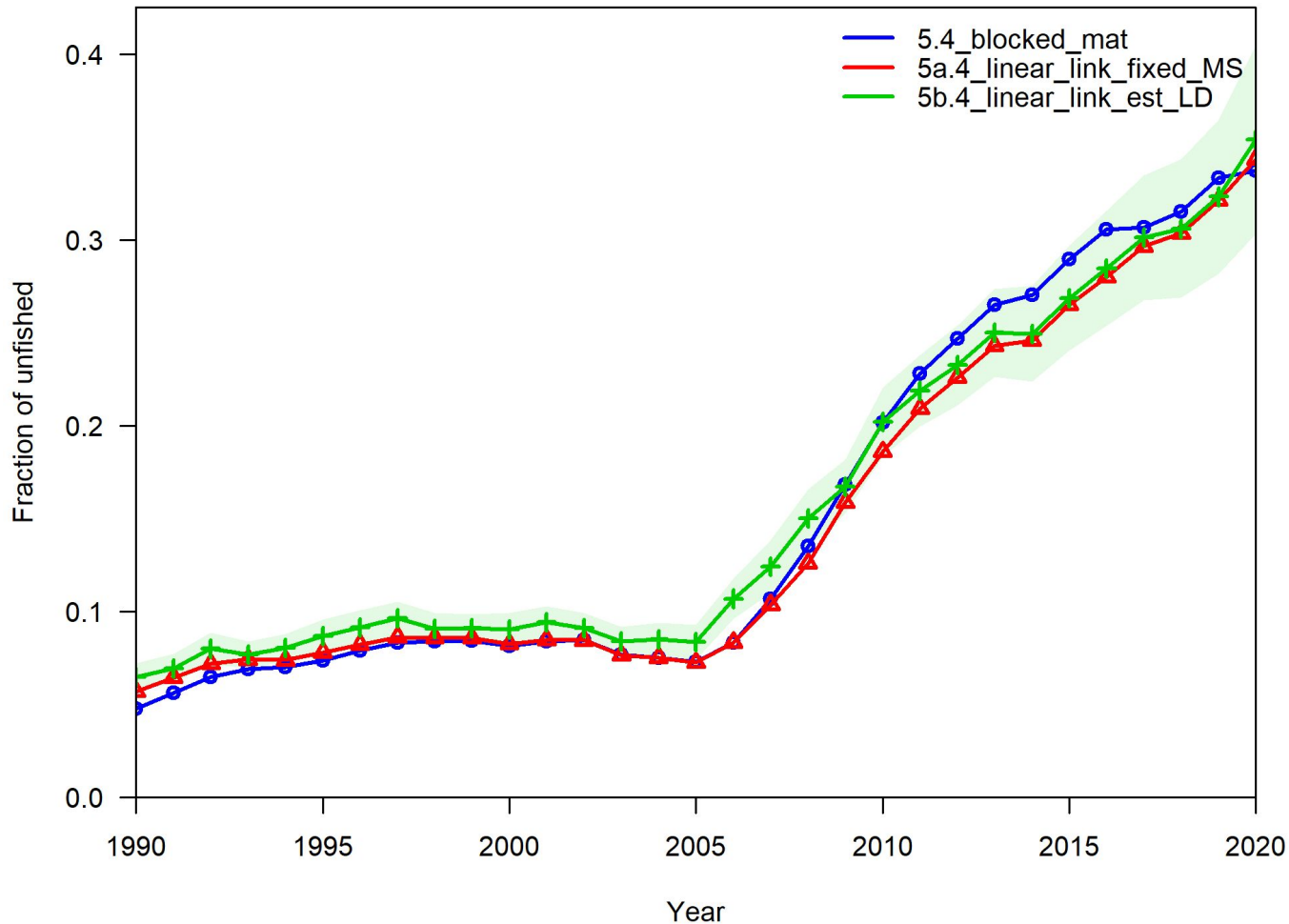
1. Let SS estimate P_t given a “guesstimate” P_{base}
2. Use a system of equations to solve for P_{base} and P_t , given E_y (from SS) and an expected P_y (from the LH group) - use as starting values.

TV Maturity - Link to SSB Results

- **Note:** Models are having extremely long run times with this feature, 5+hours even if values are fixed. Increases run time by 4x
- There is no data to estimate the scaling parameter P_t



TV Maturity - Link to SSB Results



Analytical Team Recommendation

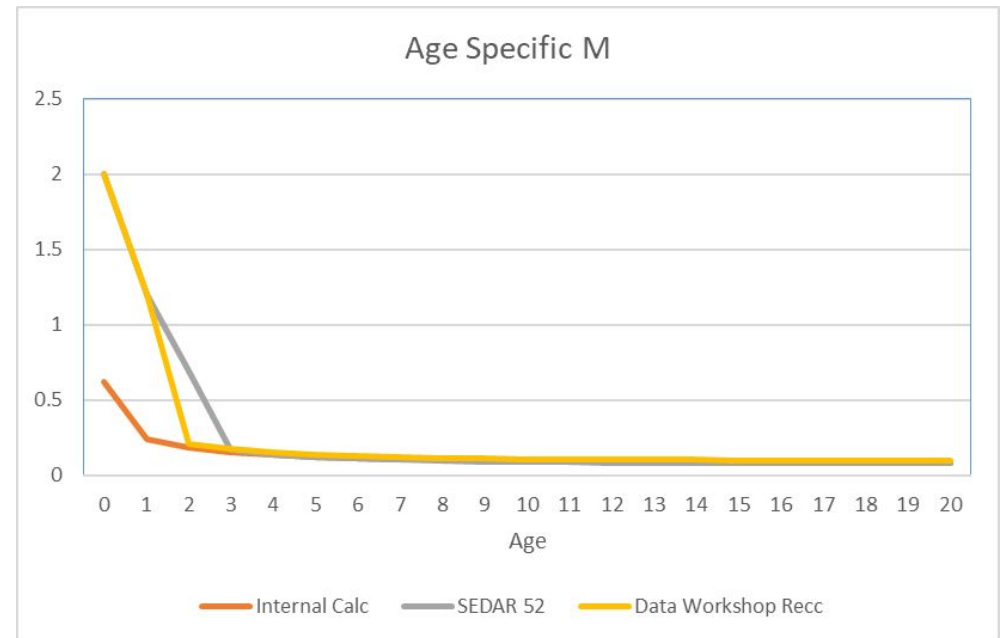
- With SSB link, model run time is too long for active development.
 - Simple diagnostics may be difficult to complete.
 - ~ 200 likelihood point difference in fixed vs blocked runs, will need to update selectivity parms (time intensive)
- Base model - constant maturity for computational simplicity
- Sensitivities
 - Fix P_t and P_{base} at parameter values that reproduce trends seen in maturity by the LH group.
 - Blocked maturity parameters

Natural Mortality Sensitivities - Explanation



M Options

- Note an increase in max age from 48 to 57 since S52
- External Calculation
 - Lorenzen scaled to Hoenig estimate (S52)
 - Lorenzen scaled to Lutjanid Then et al estimate
- Internal Calculation
 - Lorenzen scaled M across a range of ages (2-20)



The internal calculation has a very low mortality rate that did not account for high age zero mortality.

Completed Assessment TORs



Full TORS on SEDAR website:

<https://sedarweb.org/documents/sedar-74-gulf-of-mexico-red-snapper-research-track-assessment-terms-of-reference/>

Assessment TORS and Relevant Webinars

Assessment Terms of Reference

1. Review any changes in data or analyses following the Data Workshop. Summarize data as used in each assessment model. Provide justification for any deviations from Data Workshop recommendations.

- Review of all data - Webinar 1
- Review of composition data - Webinar 4 -5
- Removal of fishery dependent indices (HBT) - Webinar 7

Assessment TORS and Relevant Webinars

2. Develop population assessment model(s) that are appropriate for the available data

- Consider and incorporate as appropriate the information derived from the “Great Red Snapper Count” and other independent studies.
 - Evaluate selectivity and retention functions for all directed, discard, and bycatch fleets as appropriate.
 - Consider incorporating the Connectivity Modeling Simulation recruitment index to inform trends in recruitment for forecasting.
 - Investigate fitting length composition data directly within the SS3 model as opposed to developing age-length keys and converting length frequency to age composition external to the modeling process.
 - Explore whether available data supports the estimation of growth parameters within the model.
 - Explore whether alternate recreational fleet structures are supported in the assessment model. Specifically, determine whether selectivity functions are estimable and model stability is maintained.
- GRSC abundance and composition - Webinar 6-8
 - Selectivity and retention curves have been revisited for all data sets given the new regional split and the switch from completely age based composition to hybrid composition - Webinar 4 -5
 - Suggesting a topical working group to evaluate recruitment (i.e., CMS, unpublished larval dispersal studies, etc.)

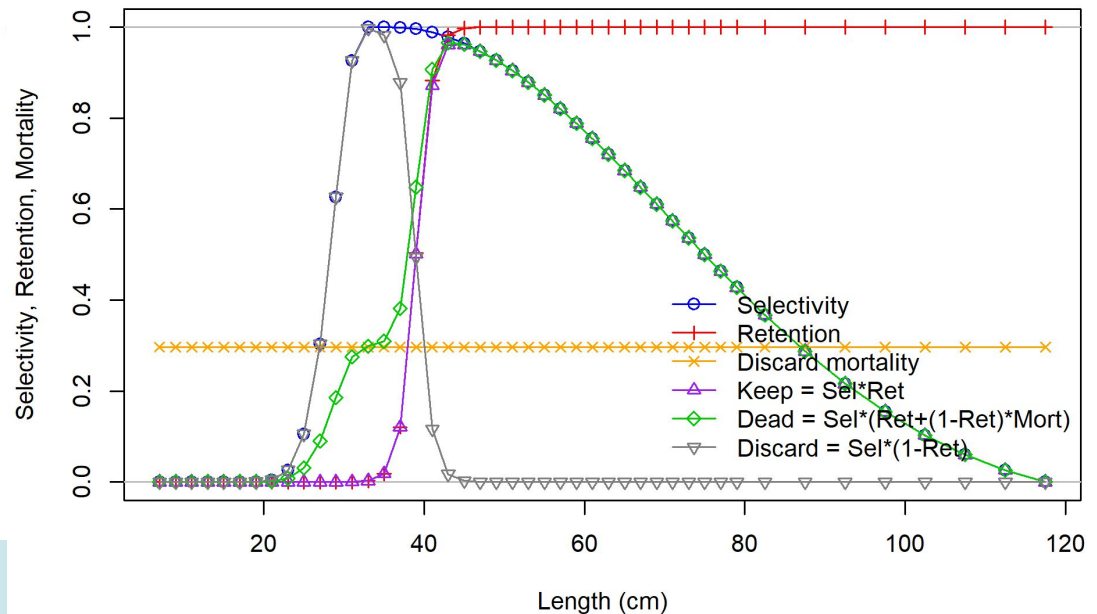
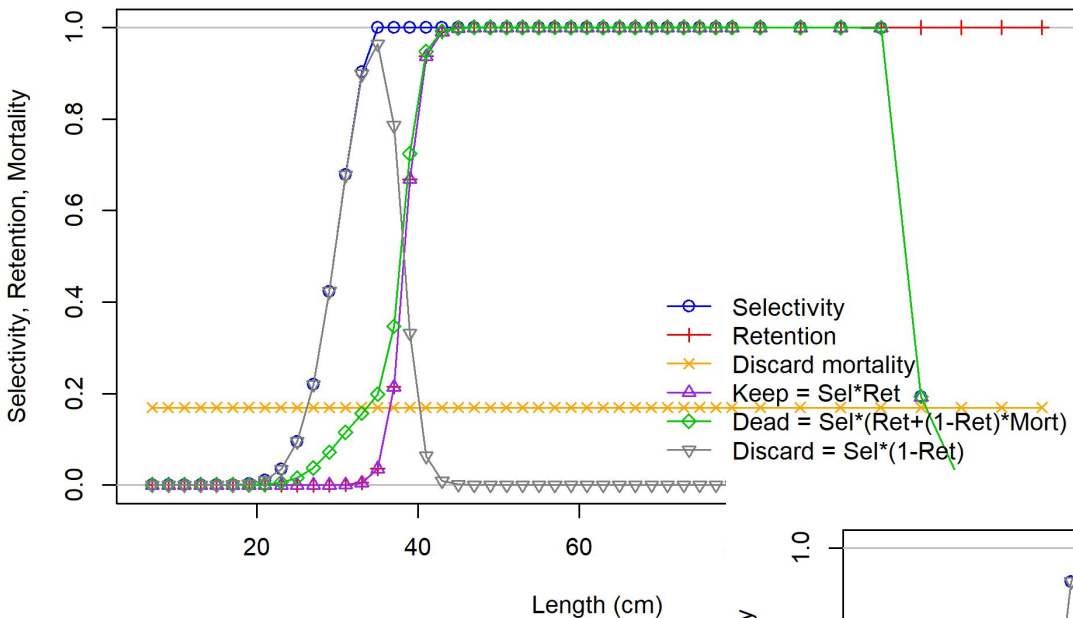


Assessment TORS and Relevant Webinars

2. Develop population assessment model(s) that are appropriate for the available data
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- Successfully incorporated and fit length comp for most fleets
- Explored growth estimation early on, but in need of paired age-length data in the model
- Private and Charter are now separated and taking on different forms

Private and Charter Fleet Separation

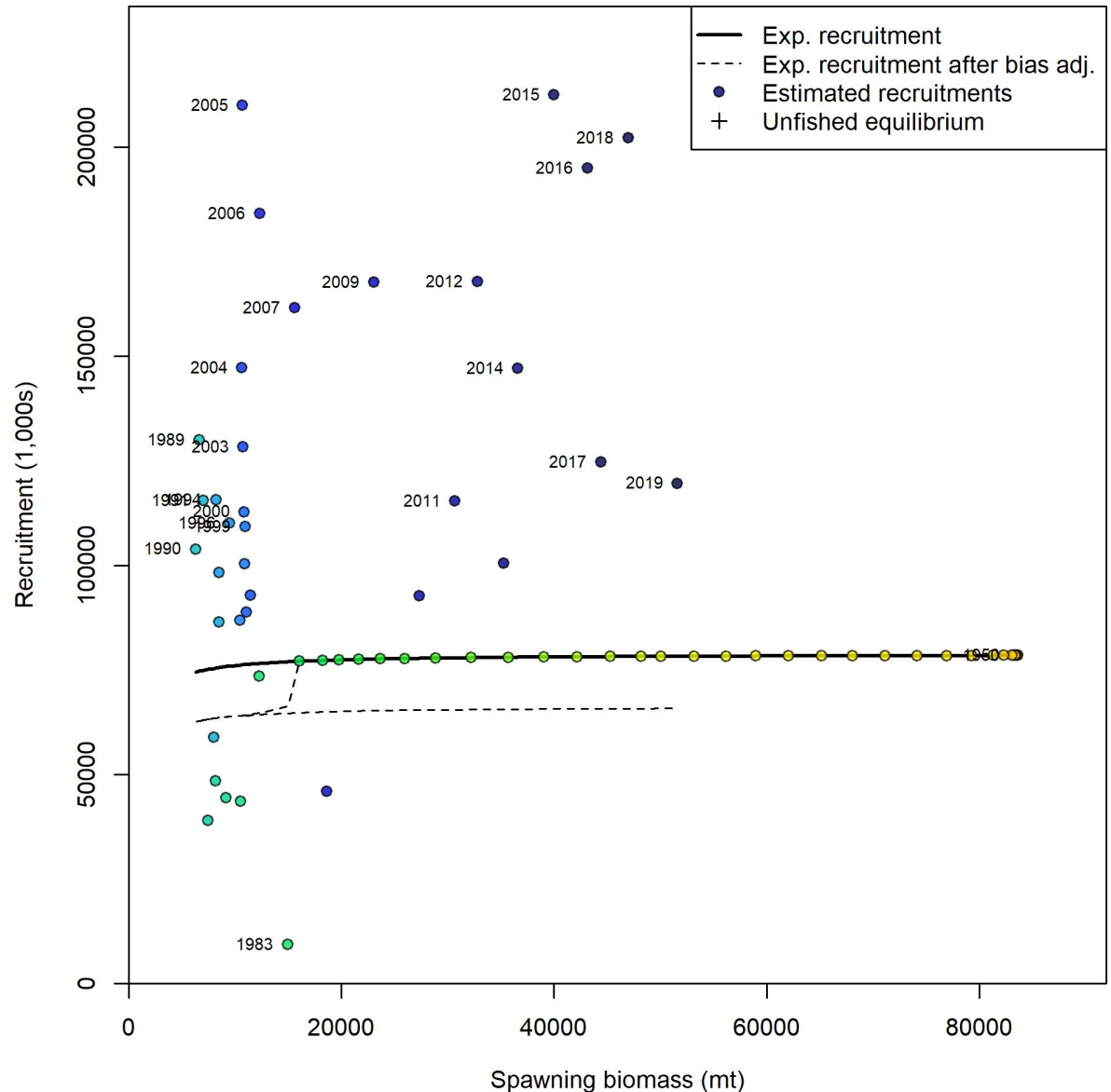


Assessment TORS and Relevant Webinars

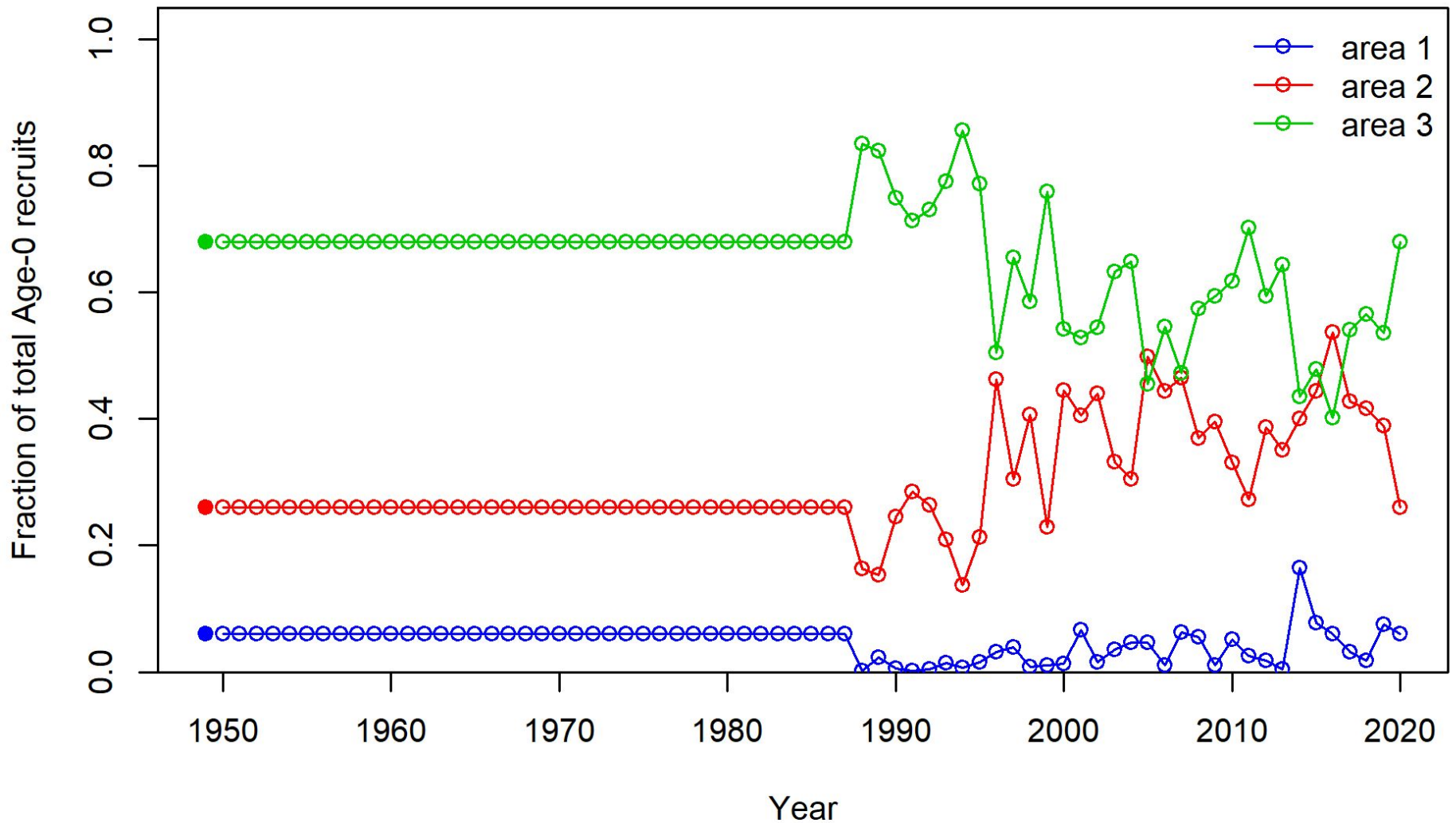
3. Provide estimates of stock population parameters, including:
 - Fishing mortality, abundance, biomass, selectivity, stock-recruitment relationship, sex ratio, and other parameters as necessary to describe the population.

Stock Recruit

Model assumes no relationship between stock size and recruitment

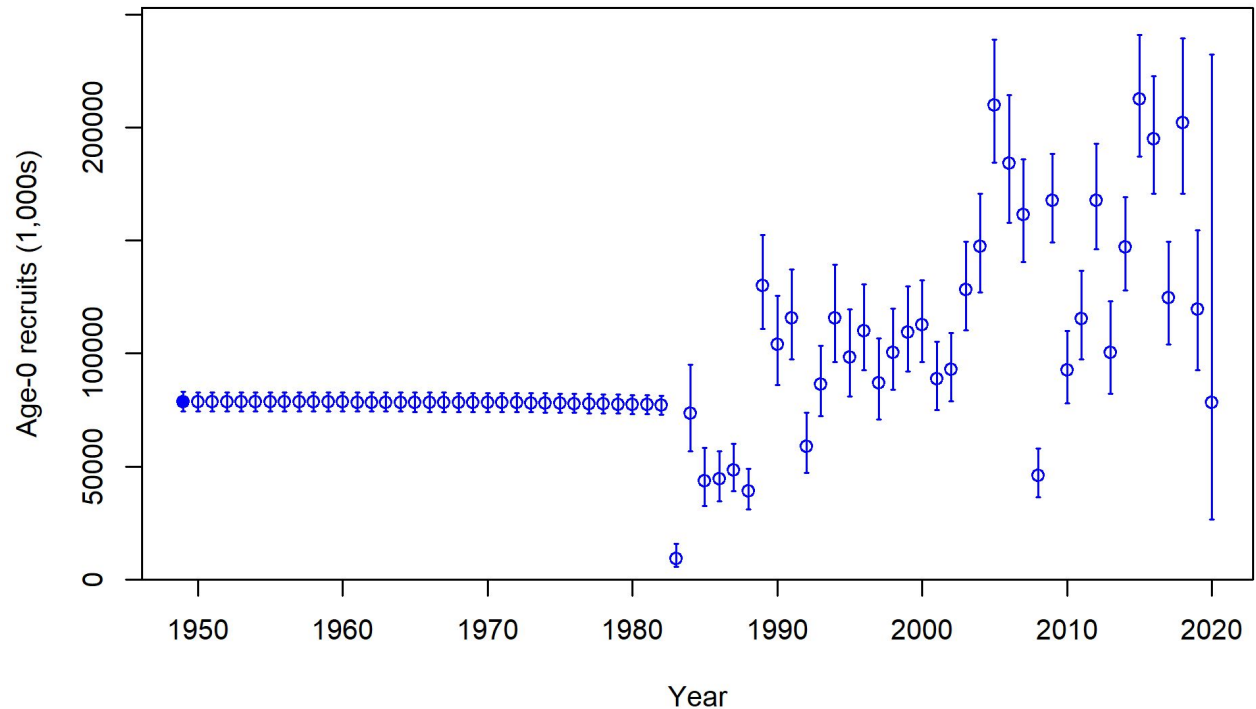


Recruitment Apportionment - Webinar 2



Recruitment - Webinar 6

No R0 block and
simple deviations
(forced shift in
productivity
removed)



Additional Biological Highlights

- Fixed growth with regional differences, based on LH working group suggestions
- SSB instead of Total Egg Production - Webinar 7
- Constant Maturity (other forms in sensitivity) - Webinar 7-8

Selectivity Highlights (Webinar 4-6)

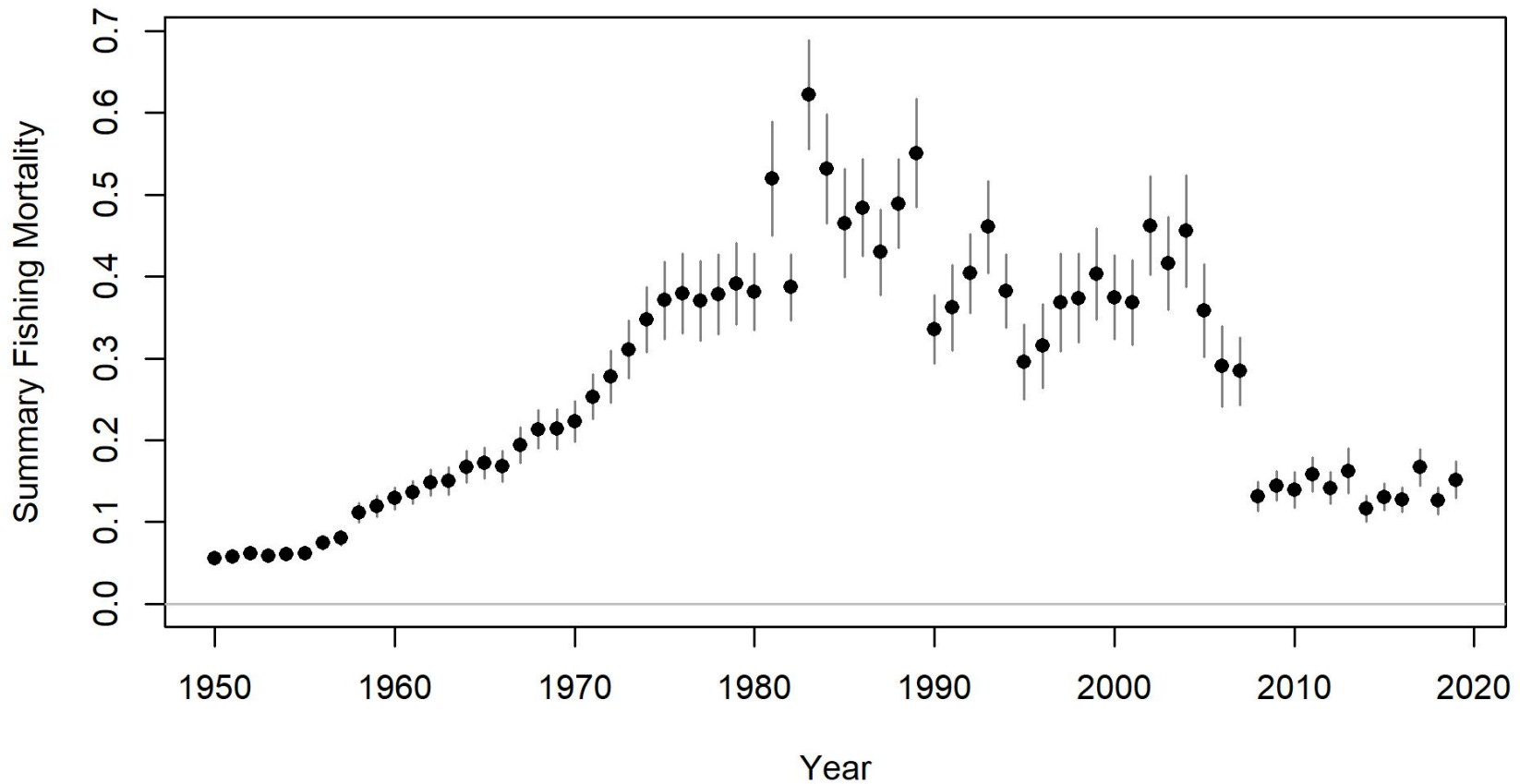
Length Based:

- Logistic fleets: SEAVID, GFISHER, Long Line and Shrimp, Fall Trawl pre 2007
- Double Normal: HL, HBT, CBT, and Private
- Summer Trawl: Cubic Spline - Webinar 5
- Mirrored: LL Central, all discard fleets mirror their non discard counterparts

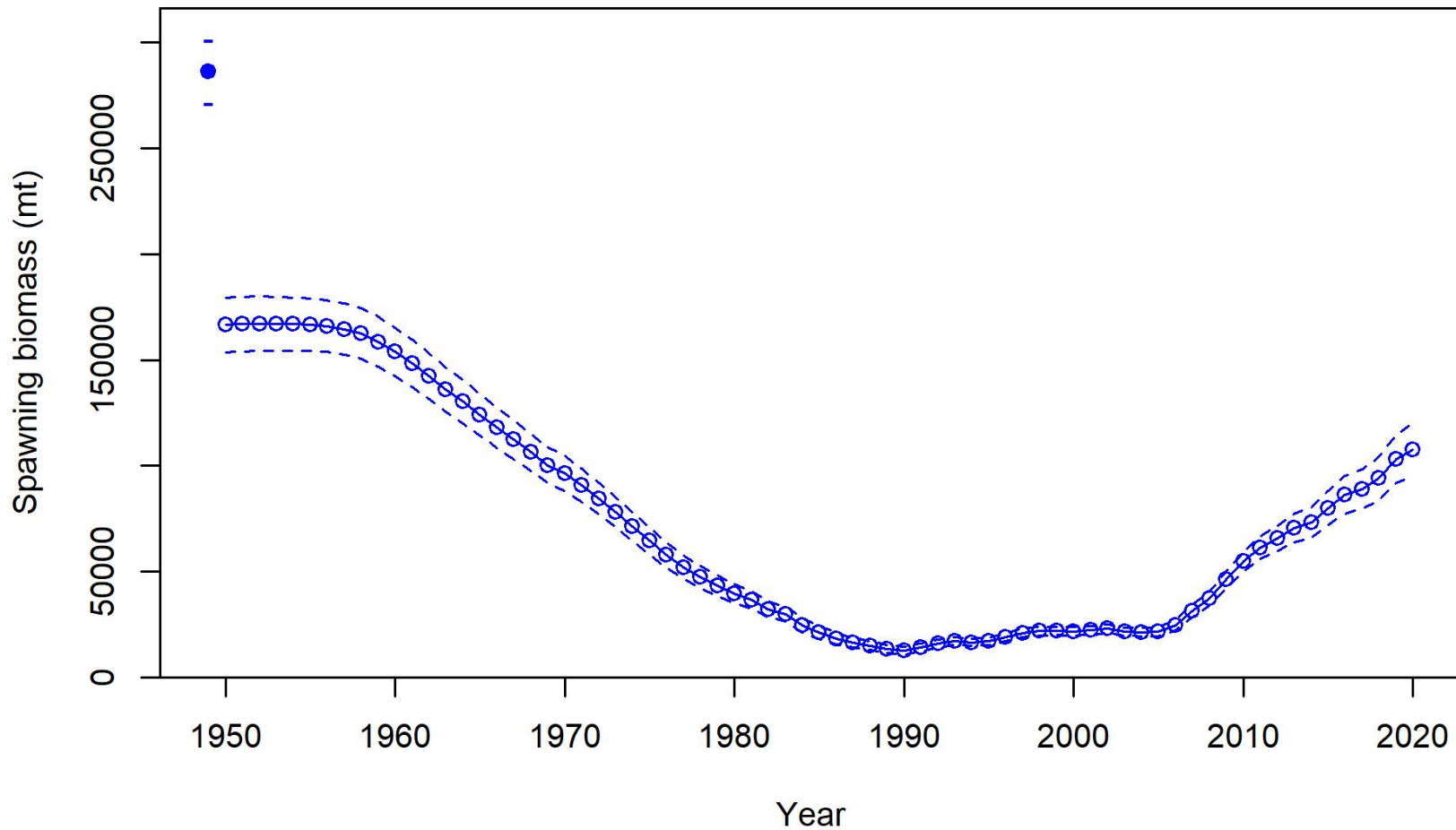
Age Based:

- Logistic: BLL
- Empirical random walk: FALL Trawl post 2007
- Double normal with constraints: GRSC

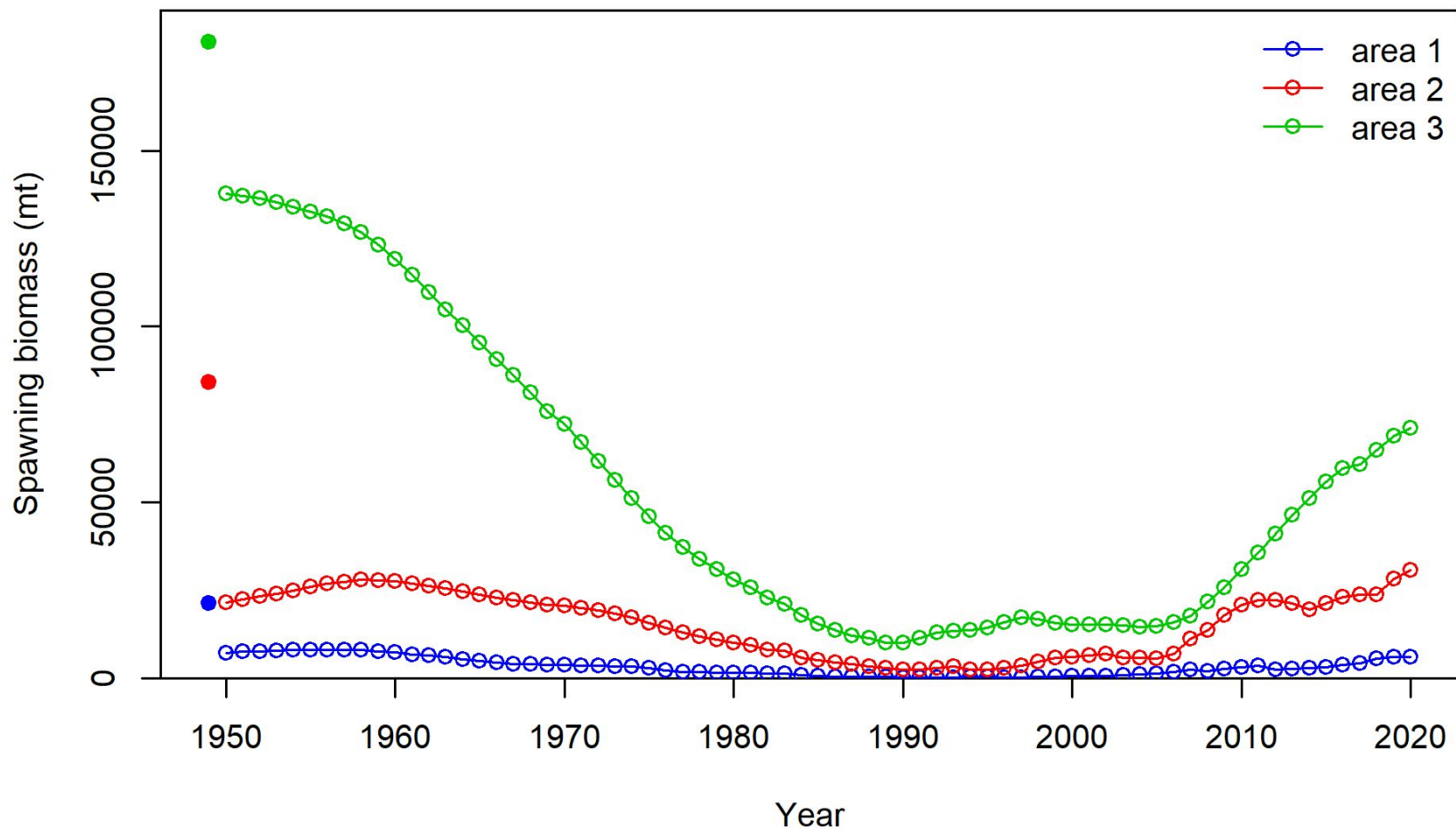
Base Model Summary F Trajectory



SSB Gulf wide



SSB Region-specific



Assessment TORS and Relevant Webinars

4. Characterize uncertainty in the assessment and estimated values.
 - Consider uncertainty in input data, modeling approach, and model configuration.
 - Provide appropriate measures of model performance, reliability, and 'goodness of fit'.
 - Provide measures of uncertainty for estimated parameters.

Model diagnostics including, goodness of fit are not provided for research track assessments given the possible flux in data streams.

Areas of Uncertainty Consideration:

- CVs for catch are fixed at a value lower than those provided prior to 1990 and provided CVs are used after 1990.
- Scale indices to the same mean ($CV = 0.2$) while keeping interannual variation.
- Weighting of length comps uses dirichlet multinomial.
- Considering a topical working group for GRSC uncertainty.
- Priors on recruitment apportionment and some selectivity parameters being estimated with limited to no data.
- Lambdas (weighting) of closed season private east recreational discard data.

Assessment TORS and Relevant Webinars

5. Provide recommendations for future research and data collection. Emphasize items that will improve future assessment capabilities and reliability. Consider data, monitoring, and assessment needs.
 6. Complete an Assessment Workshop Report in accordance with project schedule deadlines.
- Future Research recommendations (e.g.):
 - Explore alternate composition data structures (i.e., conditional age-at-length)
 - Explore the use of paired age-length data to facilitate growth parameter estimation
 - Suggestions from the ADT?
 - Topical Working Groups (e.g.):
 - Recruitment
 - GRSC
 - Recreational statistics
 - Initial conditions (equil. Catch, equil. apportionment, etc.)
 - Assessment report in progress
 - Final sensitivities for the report?
 - Maturity - Base- constant, sensitivity - blocked and linked

Discussion/Questions

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